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MAIL STOP APPEAL BRIEF-PATENTS

Atty. Docket 8016-1006

PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

Takehiko HAMADA

Serial No. 09/057,455

Filed April 9, 1998

POSITION DETECTING SYSTEM AND METHOD

Conf. No. 6428

Appeal No.

(GROUP 2881)

#16
Slanger
10/16/03

In response to the Notification of Non-Compliance mailed September 11, 2003, enclosed please find a Revised Appeal Brief.

The appropriate fee was paid at the time of filing the Appeal Brief on April 18, 2001.

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REVISED APPEAL BRIEF

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1. Real Party in Interest

The real party in interest in this appeal is the current assignee, NEC Corporation of Tokyo, Japan.

2. Related Appeals and Interferences

None.

3. Status of Claims

Claims 1-20 remain in the application. The rejection of claims 1-14 is not contested in this appeal and thus only independent claim 15 and claims 16-20 dependent therefrom are the subject of the present appeal. Claims 1-14 are hereby withdrawn from this appeal. Claims 15-19 were rejected in view of prior art and claim 20 was rejected as to form. Art was not applied against claim 20.

4. Status of Amendments

No amendments were filed after the final rejection. Claims 15-20 contested in this appeal are set forth in the Appendix.

5. Summary of Invention

The present invention detects a position of a bottom of a contact hole in an insulating film of an electronic circuit component using an electron microscope. An electron microscope typically detects changes in intensity of secondary (reflected) electrons to make size measurements (page 1, lines 12-24). However, the position of the bottom of a contact hole in an insulating film is difficult to detect because the reflected electrons do not emerge from the bottom of the hole in a manner that enables the position of the bottom of the contact hole to be accurately determined (page 3, lines 14-19). To avoid this problem, the present invention detects a current change in the specimen without using the reflected electrons (page 15, lines 11-14).

The present invention, as explained at page 15, lines 15-24 and illustrated in Figure 2, applies a voltage to a substrate of the component and the current flowing in the substrate is detected. A current does not flow through the substrate 30 when the electron beam irradiates the insulating film 31, but a current does flow through the substrate when the

beam irradiates the bottom of the contact hole 32 (the surface of the substrate). The position and diameter of the bottom of the hole are determined from the current output signal, such as shown in Figure 3.

More specifically, with reference to Figure 1, the position detecting system in claim 15 includes beam irradiating means (such as electron gun 11, Figure 1) for irradiating an electron beam toward the surface of a substrate and beam scanning means (14, Figure 1) for relatively scanning the electron beam so that the beam moves in relation to the surface of the substrate (page 12, lines 3-13). Voltage applying means (24, Figure 1) applies a voltage to a rear surface of the substrate which is scanned by the electron beam and current detecting means (25) detects the current at the rear surface of the substrate, so that when the electron beam bombards a surface of the insulating film an electric current does not flow in the substrate, but when the electron beam bombards the surface of the substrate through the contact hole, an electric current flows through the substrate to the voltage applying means (page 15, lines 15-24, Figures 1-3).

A position detecting means (in control unit 20, page 13, line 19, through page 14, line 2, and page 15, line 5, through page 17, line 2) detects the position of the bottom of the contact hole by referring to the scanning start position of

the electron beam and the position when the detected current changes.

The position of the bottom of the contact hole is detected without detecting secondary electrons and reflected electrons.

6. Issues

Whether claim 15 is anticipated under 35 U.S.C. §102 by PECKERER et al. 5,703,373, and

whether claim 20 is indefinite under 35 U.S.C. §112, second paragraph, for including contradictory limitations.

7. Grouping of Claims

The claims do not stand or fall together. Claims 1-14 are not contested in this appeal and have been withdrawn from this appeal. Claims 15-19 stand or fall together. Claim 20 stands or falls alone.

8. Argument

PECKERER et al. do not disclose the "position detecting means" in claim 15 and thus claim 15 avoids the rejection under §102.

PECKERER et al. disclose an alignment fiducial system that is used to calibrate a position of an energy beam on a film on which a useful image is made by the electron beam. A fiducial is a structure for calibrating a position of an

electron beam relative to the film. The alignment of the beam is calibrated using fiducials that are selectively spaced to detect beam drift (column 1, lines 23-29). The reference discloses that an electron beam may be scanned over electron beam absorbing layer 12 until the beam strikes aperture 16 (Figures 1-2). The beam goes through the aperture and strikes conductive structure 14 exposed in aperture 16. Current flow in conductive structure 14 is detected with device 22 (column 4, lines 23-42). That is, the fiducial electron beam detector positions a fiducial pattern relative to film over which the electron beam moves, moves the electron beam across the film, detects signals produced by the interaction of the beam with the fiducial pattern, and compares the detected signal with a reference signal to provide a position signal representative of relative beam position (column 3, lines 19-24).

However, in contrast to the invention of claim 15, PECKERER et al. already know the position of the apertures in the fiducial pattern and only concerned with the position of the electron beam relative to the film on which the beam makes a useful image since they want to be sure that the beam is in the correct position on the film when making the image. The results are used to align the electron beam (column 3, lines 25-37), not to detect the position of the apertures, whose positions are already known and are of little importance in

their own right. PECKERER et al. determine a position of the beam relative to the film using the fiducials as alignment guides. They do not disclose that this information is used to detect positions of the bottom of contact hole whose positions are not known. Accordingly, the reference does not disclose the position detecting means of claim 15, which thereby avoids the rejection under §102.

Claims 16-19 are allowable over the prior art because of their dependence from independent claim 15.

Claim 20 was rejected under §112, second paragraph, and is believed to be proper as to form. Claim 20 is directed to a system that can do two things. The system detects the position of a bottom of a contact hole, and (as set forth on line 2 of claim 20) "further" detects the position of a gate electrode on a gate oxide film. These two capabilities relate to different topographical features of the semiconductor device and are complimentary, not contradictory. The insulating film that relates to the former capability is one that prevents current flow in the silicon substrate. The gate oxide film that relates to the latter capability is one that allows current flow in the silicon substrate. By way of example, the dual capability is explained in the specification at page 7, lines 9-22, and page 18, line 14, through page 19, line 8. Since art was not applied against claim 20, claim 20 is patentable

regardless of the patentability of claim 15 and its separate consideration and allowance are respectfully requested.

In view of this, it is believed that the rejection of record cannot be sustained and that the same must be reversed and such is respectfully requested.

Respectfully submitted,

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October 7, 2003

9. Appendix

The claims on appeal:

15. A position detecting system for detecting a position of a bottom of a contact hole in a circuit component having said contact hole through an insulating film on a surface of a silicon substrate, the system comprising a beam irradiating means for irradiating an electron beam toward said surface of said silicon substrate, a beam scanning means for relatively scanning said electron beam so that said electron beam moves in relation to said surface of said silicon substrate, a voltage applying means for applying a voltage to a rear surface of said silicon substrate which is scanned by said electron beam, so that when said electron beam is bombarded onto a surface of said insulating film, an electric current does not flow in said silicon substrate, but when said electron beam is bombarded onto said surface of said silicon substrate through said contact hole, an electric current flows in said circuit component as the result of said electron beam that flows as said electric current through said silicon substrate to said voltage applying means because of the voltage applied to said rear surface of said silicon substrate, a current detecting means for detecting said electric current flowing in said circuit component, at said rear surface of said silicon substrate, and a position detecting means for detecting the

position of the bottom of said contact hole, with reference to the scanning start position of said electron beam and the position when the detected current changes, the position of the bottom of said contact hole being detected without detecting secondary electrons and reflected electrons.

16. A position detecting system claimed in Claim 15, wherein the position detecting means is configured to detect the position of the bottom of said contact hole with reference to the scanning start position of the electron, on the basis of the scanning start time of the electron beam and the detected current changing time.

17. A position detecting system claimed in Claim 15, further including a size measuring means for measuring the size of the bottom of said contact hole, on the basis of a difference in the coordinates between two positions detected by the position detecting means.

18. A position detecting system claimed in Claim 15, further including a size measuring means for measuring the size of the bottom of said contact hole, by multiplying a scanning speed of the electron beam by the time during which the current is at a changed level.

19. A position detecting system claimed in Claim 15, wherein the voltage applying means periodically changes the voltage applied to the sample.

20. A position detecting system claimed in Claim 15, configured to further detect the position of a gate electrode on a gate oxide film covering a device region confined in said surface of said silicon substrate, wherein when said electron beam is bombarded onto said gate electrode, said electric current does not flow in said silicon substrate, but when said electron beam is bombarded onto said gate oxide film, since said gate oxide film is very thin, said electric current flows in said circuit component as the result of said electron beam that flows as said electric current through said gate oxide film, said device region and said silicon substrate to said voltage applying means because of the voltage applied to said rear surface of said silicon substrate, so that said position detecting means can determine said the position of said gate electrode and said device region.

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